

# **Test Procedures For J-Crate (QM) ESS in 2003**

Version 1.0

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## **1. Scope**

This document is to specify the test procedures of environmental tests for qualification modules (QM) of AMS-02 J-crate. The purpose of the test is to check the J-crate after modifications.

The J-crate is specified by the design requirement document (rev. 6) and specification for each board. The interfaces are described in separate documents.

## **2. Hardware**

The hardware includes the following three parts:

- 1) J-Crate which is the device under test (DUT).
- 2) Power supply system to provide power for J-Crate.
- 3) Test PCs which are used for check interfaces of J-Crate.

### **2.1. J-Crate**

J-Crate consists of four main DAQ computers (JMDC) and two interface cards. Each JMDC has a single board computer (JSBC), a 2 GB memory buffer (JBU), a CAN bus interface card (JIM-CAN), a high rate data link (HRDL) and RS422 interface card (JIM-HRDL/422) and AMSWire and 1553 Bus interface card (JIM-AMSW/1553). The boards are connected via Compact-PCI backplane.

The HRDL and RS422 interfaces from all JMDC are combined in an interface card JHIF. 1553 Buses for International Space Station (ISS) are also connected to a single interface board (JLIF). This makes easy connection to NASA interfaces.

During the test, JSBC will check JMDC internal devices and make test for interfaces with test equipments.

## 2.2. Power Supply System

JMDC requires +3.3V, +5.0V and -5.2V power. JLIF needs only +5.0V and JHIF is supplied by +5V and -5.2V. In real system the powers are provided separately by different power supplies.

To simplify the test equipments, we use three power supplies to provide for the whole J-Crate. They are providing +3.3V, +5V and -5.2V. A computer controlled switch box will distribute powers to different devices. The three power supplies are also controlled by the same computer via GPIB bus.

## 2.3. Test Equipments

Test equipments are composed of three personal computers (PC). They will test all outside links from J-Crate.

One PC will test two 1553 buses. The second PC will check two HRDL interfaces and two CAN buses. The third PC will test two RS422 and 16 AMSWire interfaces.

## 3. Software in J-Crate

JSBC is built in PowerPC and CPC700 architecture. The main test programs are running under Linux operating system. The running status is displayed on a terminal via RS232 interface.

The operating system and test programs are stored in flash memory. They are started by ROM Monitor which is a simple program resides in PROM. In order to give Linux a correct time, ROM monitor will wait for a time setting via HRDL interface at startup. The time will be store a internal timer on JSBC and can be read by Linux.

All software are running on JSBC. Therefore this will check the functions on JSBC. Besides that, each part of hardware will have a program to make test. The following table lists all test programs and functions.

**Table.1. Test Programs on J-Crate**

<b>Program</b>	<b>Function</b>
jbu_mem	Test JBU memory bank by bank
Can_agent	A server to handle actions as masters and slaves on CAN buses
can_test_master	A master program to check all other JMDCs. It is only running on JMDC-1.
agent_1553	It provide server for 1553 remote terminal (RT) and bus monitors. The ISS RT is only running on JMDC-1. The two STS RT are located on JMDC-0 and JMDC-1. The STS RT on JMDC-0 is hardwired to address 28 and the STS RT on JMDC-1 is hardwire

	to address 4. The ISS RT address is fixed to 10.
agent_hrdl	It makes services for HRDL and RS422 communications. The two kind of interfaces are not operating at the same time. The agent has internal test functions which enables possibility of sending or checking test frames.
amsw_test	Since not all AMSWire links are used as they should be, only a test program is provided to specially test the 10 links.

All programs are start automatically at the startup time and keep running. The HRDL/RS422 working modes are controlled by command via message boxes. The command files are stored on JSBC and can be sent by a special program. The running status is displayed on terminal. The terminal output will be also logged in a file.

## 4. Software on Test Systems

Three test PCs are running under Linux operating system. The power control PC is running under Microsoft Windows 98 operating system. The test program's location and functions are list in Table.2.

**Table.2. Test Programs on PC's**

<b>Program</b>	<b>Location</b>	<b>Function</b>
AMS Power Control	PC-Power	Control power supplies and power switch box
1553 BC	PC-1553	1553 bus controller to test 1553 remote terminals on J-Crate.
amsw_test	PC-AMSW/422	Test 16 AMSWire links.
422_test	PC-AMSW/422	Test two RS422 interfaces, one at a time.
HRDL-A	PC-HRDL/CAN	Provide service for HRDL links with integrated test functions via interface A.
HRDL-B	PC-HRDL/CAN	The same function as above via interface B
cantest_master	PC_HRDL/CAN	Ping four JMDC slaves via CAN buses and get test result from JMDC-1 master function.
TIME-A	PC-HRDL/CAN	Send time to J-Crate via HRDL interface A
TIME-B	PC-HRDL/CAN	Send time to J-Crate via HRDL interface B
JMDC-0 terminal	PC-HRDL/CAN	JMDC-0 terminal window
JMDC-1 terminal	PC-HRDL/CAN	JMDC-1 terminal window
JMDC-2 terminal	PC-AMSW/422	JMDC-2 terminal window
JMDC-3 terminal	PC-AMSW/422	JMDC-3 terminal window

## 5. Special Procedures

This section defines some special test procedures for details of some part of test. They will be referred as a single step in the rest of procedure descriptions.

### 5.1. Power On Procedure

The procedure is defined to start from the beginning. In fact, the procedure can start from any step when previous steps are done.

1. Switch on PC-Power computer.
2. Switch on 3.3V power supply
3. Switch on +5V/-5.2V power supply
4. Turn on Power Switch Box (mode switch should be in “automatic” position)
5. Start “AMS Power Control” program.
6. Switch off and switch on again the +5V/-5.2V power supply.
7. Set switches for JMDC-0, JMDC-1, JMDC-2, JMDC-3, JFOM-B, JLIF and J422 at “ON” state. Set JLIF-Ctrl switch in Y position.
8. Start JMDC-0 and JMDC-1 terminals on PC-HRDL/CAN.
9. Start JMDC-2 and JMDC-3 terminals on PC-AMSW/422.
10. Start “1553 BC” on PC-1553.
11. Set “ON” on power supply control.
12. Double click “TIME-B” to send time on PC-HRDL/CAN when JMDC start to wait for time.
13. Start “cantest\_master” (CAN) on PC-HRDL/CAN after Linux is loaded and test programs are started on JMDC computers.

### 5.2. Power Off Single JMDC

Set JMDC switch at “OFF” state on power switch panel for the JMDC to be switched off.

### 5.3. Power Off in the Middle of Test

This is the procedure is used for power on/off test in the middle of ESS.

1. Use “Ctrl-C” to stop all test running test program.
2. Set “OFF” on power supply control

## 5.4. Power Off Procedure for the End of Test

This is the procedure to end the test normally and it will make log files are closed correctly.

1. Use “Ctrl-C” to stop all test running test program.
2. Use “Ctrl-A + X + Enter” to close all JMDC terminals.
3. Set “OFF” on power supply control

## 5.5. CAN Buses Test Procedure

There are two CAN buses which link four JMDCs and PC-HRDL/CAN (via EPP\_CAN box). The program “cantest\_master” on PC-HRDL/CAN will act as master to check each JMDC alternatively. After all JMDCs are started and test programs in JMDC are running, this test program can be started (see step 13 on section 5.1). The program should be run until switch off power (see step 1 in section 5.3 and 5.4).

In order to test JMDC running master and slave modes in the same time, JMDC-1 is also running in master mode to test all other JMDCs. The result will be displayed on JMDC-1 terminal and will be read by “cantest\_master” at the end.

## 5.6. AMSWire Test Procedure

The “amsw\_test” program is started automatically on JMDC. The links between JMDCs are checked continuously. The four JINJ ports on front panel from each JMDC have to be checked by PC-AMSW/422.

Since interface card on PC-AMSW/422 has problem on PCI core at the moment, we have two procedures, short test for current situation and long test after problem fixed.

The short test will only run “amsw\_test” (AMSW) program on PC-AMSW/422 for a short time (1 – 10 min.). Then it should be stopped by “Ctrl-C”. This can be repeated several times during the whole test period. This program should not run together with “422\_test” program at the same time in the current situation.

The long test will be no restrictions. It can just run like “cantest\_master” which it starts after power on (add as step 14 in section 5.1) and stops before power off (step 1 in section 5.3 and 5.4).

## 5.7. Switching HRDL and RS422 links

There are two HRDL links and two RS422 links. They are also four JMDC's

which are enable make transmit. They can not be tested at the same. All JMDC's are started in HRDL RX mode when computer is up.

To check the results, one has to see at least once that all JMDC received data and the JMDC for transmission has transmitted data. On PC side, the program should display at least once for both transmitted and received data. After checking, you may switch the links. The following steps define the procedure of changing HRDL and RS422 links.

1. Make sure Digi RS422 cable is disconnected from PC to adaptor box.
2. Start "agent\_hrdl" on interface B (HRDL-B)
3. Type command "ton" at the JMDC terminal which you would like to test transmitter. This will switch on the transmission.
4. Type "command "toff" at the JMDC terminal to stop transmission test.
5. Change to another JMDC and make the same steps as 2 – 3.
6. Press "Ctrl-C" to stop "agent\_hrdl" on interface B.
7. Set power switch for JFOM-B to "OFF" state after the last JMDC has tested.
8. Set power switch for JFOM-A in "ON" state.
9. Start "agent\_hrdl" on interface A (HRDL-A).
10. Set "ton"/ "toff" for all powered JMDCs one by one as 2 – 4 for B.
11. Stop "agent\_hrdl" on interface A by "Ctrl-C".
12. Set power switch for JFOM-A to "OFF" state.
13. Type "rs422" on each JMDC terminal to switch interface from HRDL to RS422 mode.
14. Plug Digi RS422 cable to connect PC and adaptor box for J422-A.
15. Start "422\_test" program (RS422) on PC-AMSW/422. All JMDCs should start to receive data.
16. Set "ton" / "toff" as for HRDL test to check transmission on each JMDC one after the other (ref. to step 2 – 4).
17. Stop "422\_test" by press "Ctrl-C" after last transmission test is finished.
18. Change Digi RS422 cables from adaptor box for J422-A to box for B.
19. Repeat the steps 15 – 17 just for one JMDC.
20. Unplug Digi RS422 cables from adaptor box. (important!!!)
21. Type "hrdl" on each JMDC terminal to switch JMDC software from RS422 to HRDL mode.
22. Set power switch for JFOM-B to "ON" state.

## 5.8. Switch 1553 Buses and RT

There are two STS interfaces for 1553 buses. They both act as remote terminals (address 4 and 28) and are running all the time. Two ISS interfaces (Y and Z) is controlled by power switch box. Only one operates at a time. All four JMDC's are connected to the same interface for ISS and only JMDC-1 (fixed for test) is running in RT mode. Other three are running in bus monitor (MT) mode to give the running information and their interfaces are tested in the same time.

In real system STS and ISS buses are not connected together. In order to simply the test procedure, they are connected on the same buses (A and B). The bus monitors can see the results for all RT tests. The test procedure is described as the following.

1. Keep "1553 BC" running all the time after power on (see Power On Procedure). It is not necessary to stop it until the end of test. By default, it starts to test RT10 (ISS interface) on bus A.
2. Watch the bus monitors to see the result. You should see the RT10 is active and bus is A.
3. Press "B" on "1553 BC" screen. It will change to bus B. You should see the change from bus monitor.
4. Change power switch "JLIF-Ctrl" from Y to Z state. You should see no change on display since it is still working on RT10 on bus B.
5. Press "A" on "1553 BC" screen. It should change back to bus A.
6. Press "4" on "1553 BC" screen. It will change to RT4 on bus A.
7. Press "B" to change to bus B as step 3.
8. Press "2" to change to RT28 on bus B.
9. Press "A" to change to bus A.
10. Change back power switch for "JLIF-Ctrl" to Y state to end the procedure.

## 6. Complete Test Procedures for Thermal Cycles

There will be 5 thermal cycles this time for J-Crate. The first cycle and the last two cycles need functional test at both high and low temperatures. Each functional test has about one hour.

The test procedure is specified here:

1. Power on all four JMDC's (see section 5.1).
2. Run short AMSWire test (section 5.6) for one minute.
3. Run a quick HRDL/RS422 test (section 5.7).
4. Run a quick 1553 test (section 5.8).
5. Switch off power (section 5.3).

6. Wait for 1 min.
7. Power on again all four JMDCs (starting from step 11 in section 5.1).
8. Repeat step 2 – 4.
9. Switch off JMDC 0 and 2 (section 5.2).
10. Make short AMSWire test (section 5.6) periodically in the current situation.
11. Keep running transmission on JMDC-1 via one of the four HRDL/422 link without switch. The different thermal cycles may choose different link.
12. Keep running “1553 BC” on one bus of RT10 for about 10 min. without change. In different cycle may run on different bus.
13. Change “1553 BC “ to RT4 on the same bus until the end of test for JMDC-1 and 3.
14. After about 20 min. power off all JMDCs (section 5.3).
15. After Linux starts on all JMDCs, power off JMDC-1 and 3 (section 5.2).
16. Repeat the same work in step 10 and 11 for JMDC-0.
17. Change “1553 BC” to RT28 on one of bus and keep running until the end.
18. Power off J-Crate (section 5.4).
19. Copy logfiles to a specific directory for this test period.s